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International Economics Department
The World Bank
March 1991
WPS 622

How Factors in Creditor Countries Affect Secondary Market Prices for Developing Country Debt

Sule Özler
and
Harry Huizinga

Flat-rate deposit insurance, combined with limited liability, encourages banks — especially poorly capitalized banks — to gamble with depositors' money. A bank's heavy exposure in developing country debt increases the secondary market price; strong bank capitalization decreases it.

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This paper -- a product of the Debt and International Finance Division, International Economics Department — is part of a larger effort in PRE to understand the secondary market for developing country debt as part of its analysis of voluntary market-based debt and debt service reduction. Copies are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Sheilah King-Watson, room S8-040, extension 33730 (40 pages).

Bank loans to many developing countries trade at a discount on the secondary market. These discounts are typically assumed to reflect only the repayment prospects of the borrower country.

But Özler and Huizinga demonstrate that factors in the creditor countries have a major impact on secondary market prices. Th.. empirical investigation suggests a systematic relationship between secondary market prices and the size distribution of banks' portfolios.

There is a strong negative correlation between discounts in the secondary market and U.S. banks' heavy exposure to developing country debt. They estimate that every US$4 billion increase in a large bank's exposure to a country reduces the discount 10 to 15 cents on the dollar.

They also find that discounts and total bank capital are strongly positively correlated over time: a US$8 billion increase in the capital of the largest U.S. banks increases discounts by nearly 25 cents on the dollar.

They explain their results with a simulation model of a representative bank with minimum capital requirements, flat-rate deposit insurance, and limited liability. The bank's portfolio adjustment decision involves trading risky foreign loans in the secondary market or making short-term domestic loans. The model yields a negative relationship between the banks' exposure to developing countries and discounts in the secondary market.

This is because flat-rate deposit insurance, combined with limited liability, encourages banks to gamble with depositors' money and to choose a more heavily concentrated developing country loan portfolio. Similarly, poorly capitalized banks with deposit insurance benefit more than well-capitalized banks do from a risky developing country loan portfolio.

How Factors in Creditor Countries Affect Secondary Market Prices for Developing Country Debt

by
Sule Ozler
(Department of Economics, University of California, Los Angeles
and John F. Kennedy School of Government, Harvard University
Cambridge, MA 02138)
and
Harry Huizinga*
(Department of Economics, Stanford University
Stanford, CA 94305)

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* We thank Alberto Alesina, Raquel Fernandez, Stijn Claessens, Daniel Cohen, Robert Kahn, Graciella Kaminsky, Maurice Obstfeld, George Pennacchi, Guido Tabellini, and especially Kenneth Froot for helpful discussions, and Robert L. Whetten for valuable advice on the Monte Carlo simulation algorithm. We are particularly grateful to Kenneth Rogoff for many insightful comments. We have also benefited from the comments of seminar participants at U.C. Berkeley, Boston, Harvard, and Yale Universities, and of participants at NBER Summer Institute. Part of this research was done when Sule Ozler was a visitor at the National Bureau of Economic Research. Finally, the authors gratefully acknowledge the support provided by the Debt and International Finance Division of the World Bank.

1 Introduction

In the secondary market for developing country debt, bank loans to many countries trade at a discount. The discounts are typically assumed to reflect only the repayment prospects of the borrower countries. In fact, secondary market prices are taken as a guide in discussions of the possible debt relief and valuation problems associated with developing country debt (for example see Borensztein and Pennacchi (1989)). Actual debt-reduction schemes such as the offer of the Philippines to repurchase between $1.2 billion and $1.4 billion of its own debt, have also been guided by secondary market prices (WSJ, September 18, 1989). To the extent that secondary market prices are systematically affected by factors other than countries' repayment prospects, however, debt relief or buyback decisions based on just the secondary market prices will be contaminated and misguided.

In this paper we demonstrate that creditor country factors have a major impact on secondary market prices. Our empirical investigation suggests a systematic relationship between secondary market prices and the size distribution of banks' portfolios. Large U.S. banks' exposures to developing countries and discounts in the secondary market are found to be strongly negatively correlated, even when borrower characteristics and the size of the market are controlled for. The magnitude of this effect is substantial: a four billion U.S.$ increase in the exposure of the large banks to a country is estimated to reduce the discount 10-15 cents on the dollar. The empirical investigation also suggests that discounts and bank capital aggregates are strongly positively related over time: an eight billion U.S. $ increase in the capital of largest U.S. banks is found to increase discounts by near 25 cents on the dollar.

An explanation for the empirical results is provided with the aid of a simulation model. The model is of a representative bank that faces minimum capital requirement, flat rate deposit insurance, and limited liability. The bank's portfolio adjustment decision involves trading risky foreign loans in the secondary market and making short term domestic loans. The model yields a negative relationship between banks' exposure to developing countries and the discounts in the secondary market. This is because flat rate deposit insurance, combined with limited liability, encourages banks to gamble with depositors' money, and to choose a more heavily concentrated developing country loan portfolio. Similarly, poorly capitalized banks that enjoy deposit insurance benefit more from a risky developing country loan portfolio than well capitalized banks.

The model is simulated by holding default probabilities of countries equal so as to focus on creditor country factors that affect secondary market prices. Simulations permit us to calculate, for example, that an increase in the coverage of deposit insurance from 0% to 75% results in higher discounts by 5 cents on the dollar for large countries (based on 1985 parameter values and the assumption of .5 default probability for all developing countries). A thirty percent increase of bank capital leads to a 12 cent increase of the discount for the large countries. In addition, the simulations suggest near 3.5 billion expected loss for the federal deposit insurance agency. Finally, the magnitude of the impact of exposure distribution on secondary market prices are found to be consistent with our empirical estimations.

A competing explanation for the observed negative relationship between bank exposure and secondary market discounts stems from the behavior of the multilateral lending agencies and the large creditor country governments. It may be argued that these institutions provide implicit subsidy to the banks in order to avoid financial instability. Loans from these institutions to large borrowers would presumably enhance repayment prospects of these borrowers, which could explain why their debt trades at lower discounts. While we can not rule out that differential treatment by multilateral lending agencies affects secondary market prices, we show **empirically that the presence of deposit insurance agency renders the relationship between stock market value and bank exposure convex. This result lends additional credence for our explanation of cross country differences in secondary market prices.**

Overall, we demonstrate that creditor country factors such as the compositions of banks' developing country loan portfolios, and the regulatory environment are significant determinants of secondary market prices. These findings have two important policy implications. First, our findings undermine the argument for using secondary market prices as guidelines for possible debt relief to developing countries, as it is arbitrary to render debt forgiveness dependent on the particulars of creditor country financial institutions and bank regulation. The second policy implication of our findings concerns debt buybacks. In several recent papers Bulow and Rogoff (1988 a,b) have argued that debt buybacks may be harmful to the debtor country because the country ends up paying the average market price to retire marginal debt. The presence of deposit insurance strengthens the argument that the country (in particular a large exposure country) pays too much, since the market price now reflects the average payment per dollar of debt from the country, as well as an expected payment from the deposit insurance agency.[1]

Finally, the finding that countries that buy back debt have to pay a premium over expected future repayment is consistent with Krugman (1990) who argues that deposit insurance biases the banks against providing debt relief. Both straight debt relief, which affects a country's adjustment effort, and ~~debt~~ buybacks tend to lower the value of the banks' contingent claim on the deposit insurance agency. Our empirical evidence suggests that heavily indebted countries will experience more difficulty obtaining debt relief or repurchasing their debt than lightly indebted countries and that heavily exposed banks will be more biased against debt releif and repurchases than lightly exposed banks.

The remainder of this paper is organized as follows. Section 2 contains the empirical evidence. We present the model in Section 3, and also discuss the simulation results, and their implications for bank regulatory practice. Section 4 presents evidence on banks' stock market valuation. Section 5 contains a summary and conclusions.

2. Does Bank Exposure Affect Secondary Market Prices ?

2.1 A Cursory Inspection of the Data

While the debt obligations of a number of developing countries are being traded at large discounts, there are several developing countries with debt that appears to be at par. In this section we will first present some distinguishing characteristics of the two groups of countries. Second, discount and bank exposure data are presented for the countries for which debt is traded at a discount.

A cursory look at the data suggests that the debt of countries with bad repayment prospects is more likely to be traded at a discount in the secondary market. Repayment prospects of countries have typically been measured by their general economic chararacteristics. Economic characteristics of borrowers that are identified as important measures of risk have been employed in a wide range of empirical studies concerning developing country debt: predicting the occurence of repayments difficulties, as well as investigating credit terms (for reviews see McDonough (1982), Eaton and Taylor (1986); recent studies include Ozler (1990 a b)), and in the analysis of secondary market prices (Berg and Sachs (1989), Cohen (1988), Hajivassiliou (1988), Huizinga (1989), Sachs and Huizinga (1987), and Purcell and Orlanski (1988)). We employ variables similar to the ones employed in the previous studies and these variables are: debt-to-exports ratio, reserves-to-imports ratio, real GNP per capita, lagged value of investment-to-GNP-ratio, rate of inflation, debt-to-GNP ratio, imports-to GNP-ratio, and reserves-to-GNP ratio ratio. In addition to these standard indicators, some structural variables have also been considered. These include the share of agriculture in GDP and a measure of income distribution. A lower agricultural base and unequal income distribution are both argued to contribute to political instability and therefore a less favorable environment for timely repayment.

In Table 1 the means and standard errors of the repayment indicators for the countries in our sample are presented. Our data contains information on 46 developing countries for the period of 1986-88. The debt of 25 countries was traded at a discount. Overall, the repayment indicators appear worse for these 25 countries. Furthermore, almost all of the countries in this group have had rescheduling agreements with their creditor banks, in contrast to the remaining group with almost no reschedulings.[2]

Table 1 also indicates that the countries with debts that are traded at a discount have larger debt outstanding to private creditors. A closer inspection of this variable for countries that are not in the traded group is instructive. In this group countries that may be judged to have good repayment prospects have larger outstanding debt to private creditors: near 16 billion real U.S. dollars for Korea and near 6 billion 1986 U.S. dollars for Greece. In contrast, countries with relatively bad repayment prospects also appear in this group, such as Ethiopia, and Trinidad-and-Tobago. Debt to private creditors are .08 billion real U.S. dollars, and .19 billion real U.S. dollars for Ethiopia and Trinidad-and-Tobago respectively. One plausible suggestion drawn from these observations is that transaction costs of trading private debt in the secondary market, prevents trading for countries with small amount of private debt.

Table 2 presents some summary information concerning the secondary market discounts for the 25 countries whose debt was traded at a discount in the market and bank exposures for the 1986-88 period. The discounts presented in this table are calculated using bid prices. The mean discount for all countries over the period 1986-88 is 54.24 (with a standard deviation of 24.24) and the mean exposure is $U.S. 2.28 billion (with a standard deviation of $4.11 billion). A cursory inspection of the data, on a country by country basis, shows that small borrowers, such as Bolivia, Liberia, and Sudan, trade at rather large discounts, in contrast to the larger borrowers.

Another interesting feature of Table 2 is the pattern of the secondary market spreads, calculated as the percentage differences between the offer and bid prices quoted in the secondary market. For countries with large discounts, spreads are also quite large, suggesting that an investigation of bid prices only may be misleading.

2.2 Empirical Specification

Trading of loans at a discount in the secondary market have taken place only for some of the indebted countries. As the discussion in the data section indicates, on average those countries are less creditworthy and they have larger private debt. Accordingly, define T* as follows (for convenience time and country indicators are omitted):

$$(1) \qquad T^{*} = \beta \phi + u_1$$

where T^{*} = a latent variable such that, if $T^* > 0$ then we observe trading at a discount in the secondary market, but if $T^* <= 0$ then we do not observe trading at a discount in the secondary market,

ϕ = variables that determine the occurrance of trading in the secondary market, including repayment indicators and the magnitude of debt to private creditors,

u_1 = normally distributed error term with standard error σ_1.

The magnititude of discounts has been shown to be related to creditworthiness indicators. In addition, as posited in this paper, the discounts are expected to be influenced by bank exposure and capitalization rates as described below:

$$(2) \qquad D^* = \gamma \phi' + u_2$$

where D^* = discount in the secondary market,

ϕ' = in addition to the variables in ϕ bank exposure and bank capital are included,

u_2 = normally distributed random error term with a standard error σ_2.

However, we observe positive discounts only when $T^* > 0$, and the debt appears to be at par otherwise.

$$D = D^* \quad \text{if} \quad T^* > 0,$$
$$D = 0 \quad \text{otherwise}.$$

It is well known that if the sample is censored, as it is here, employing data only for those countries with positive discounts and using least squares method to estimate an equation described as in (2) yields biased and inconsistent parameter estimates. Alternatively, one may employ all the observations by assigning zeros to those countries for which positive discounts are not recorded, and employ least squares method. This approach implies that if the debt of those countries were traded, the secondary market price would be zero, which obviously is incorrect. Accordingly, we employ a censored regression estimation technique as discussed next.

The model described above is a Tobit model (Tobin 1958) (type two Tobit model according to the classification of Amemiya (1984)). The standard Tobit model is a special case of the model where $T^* = D^*$. It has been shown that Heckman's two-step estimator (Heckman 1976) can be used in this type of a model (Amemiya (1984)) and that it yields consistent parameter estimates. According to this method, one first estimates the probit model described in equation (1) using maximum-likelihood procedure and obtains the inverse Mills' ratio (or the hazard rate).[3] The second stage equation is:

$$(3) \qquad D = \gamma \phi' + \gamma_1 \lambda + \epsilon_2 \qquad \text{for } D > 0,$$

where λ = inverse of the Mills' ratio (hazard rate),

ϵ_2 = error term with mean zero.[4]

Equation (3) is estimated after replacing λ with its estimated value form equation (1), and using ordinary least squares method. The problem with this approach is that, the asymptotic variance-covariance matrix of the Heckman estimator is not consistent.[5] It has been pointed out by Lee (1982), however, that consistent estimates of the variance covariance matrix can be obtained by applying an estimator similar tho the heteroskedasticity consistent estimator developed by White (1980). Accordingly, in this paper we use Heckman's two step estimator and follow the idea of Lee (1982) so as to obtain consistent estimates of equation (3).

2.3 Estimation Results

In this section we present results from the estimations of the equations described in the previous section: the probit specification for the occurrence of trading in the secondary market as in equation (1), and the secondary market discounts specified as a Heckman equation as in (3). The primary result of our empirical investigation is: holding repayment prospects of the borrowers constant, the discount in the secondary market decreases with increased bank exposure.

In order to investigate the robustness of these results we attempted a number of alternative specifications for the two equations. Two issues require attention. First, it is important to establish that the results are not a consequence of a particular choice of economic indicators as measures of country risk among the potential ones. Second, the results should not be contaminated by specific market characteristics such as its size. In order to address the first potential problem we employed alternative specifications of country characteristics. To address the second source of concern, we calculated the discounts as averages of bid and ask prices in the secondary markets, alternatively we employed lagged values of spreads as an explanatory variable in a specification where the discounts are calculated from the bid prices only.

In Tables 3-6 we present estimation results for two primary empirical models, with five different speficatiors each for the probit as well as the Heckman equations. The second stage equations differ from the probit equations by the inclusion of bank exposure and bank capital variables. We next describe the differences between these models and various specifications: (In addition to the variables that are described below, each specification employs region-specific and quarterly dummy variables.) Model 1 (presented in tables 3-4) specification (1) incorporates the following variables: stock of debt to private creditors, debt-to-exports, reserves-to-imports ratios, real GNP per capita, the inflation rate and the ratio of country exposure to bank capital. Specifications 2-4 differ from 1 primarily by inclusion of investment-to-gnp ratio, a measure of income distribution, and share of agriculture in gdp, respectively. Specification 5, is like specification 1, but the dependent variable is the discount calculated using only the bid price. In addition, in specification 5, the lagged value of the spread between bid and ask prices is incorporated as an explanotory variable. Model 2 (presented in tables 5-6) primarily replaces debt-to-exports and reserves-to-imports by debt-to-GNP, imports-to- GNP, and reserves-to-GNP. Alternative specifications of Model 2 are structured analogous to the alternatives of Model 1.[6]

Table 3 shows that higher debt to exports ratio, higher inflation, lower GNP per capita, and lower reserves to imports ratio increase the likelihood that, debt of a country is traded at a discount in the secondary market. (The estimated probabilities of trading are large for all the countries, for which their is trading and they drop dramatically for the remaining countries.) The amount of debt outstanding to private creditors increase the likelihood of trading.

Table 4 indicates that, with the exception of the income distribution variable, variables that contribute towards the occurence of trade, increase the magnititude of discounts; the variables that decrease the likelihood of trading decrease the magnititude of discounts. The sign of the agriculture to gdp ratio is consistent with Berg and Sachs (1989). The sign of the income distribution variable, however, differs from that of Berg and Sachs: we find that the debt of countries with historically worse income distribution were traded at lower discounts in the secondary market. The bank exposure is found to be negatively related to the discouts.

Table 5 indicates that GNP per capita and inflation rates continue to hold the same signs as in Tables 3-4, and they remain important determinants of trading. Higher reserves- to-GNP, higher imports-to-GNP, higher debt service payments to exports ratio all reduce the likelihood of trading. Higher debt-to-GNP ratio is shown to increase the likelihood of trading. Estimated probabilities from all these specifications also seem reasonable in that actual no-trading countries are assigned quite low probabilities of being traded, in contrast to the remaining countries. The discount equation estimations for this model are presented in Table 6. Except for income distribution all the variables continue to hold the same signs as in Table 5. As in Model 1, worsened income distribution is found to contribute to increased probability of trading but it appears to reduce the discounts. Exposure variable is found to be negatively related to the discounts.

Overall, the signs of repayment indicators are consistent with their expected signs: high debt ratio for a given amount of penalty for non-payment makes default more likely. The negative sign of reserves to gnp ratio suggest that it is an indicator of the level of international liquidity of the borrower. A high ratio of imports to gnp makes the borrower more creditworthy, since the borrower becomes more vulnerable to trade embargos. High inflation appears to be an indicator of a larger probability of balance of payments crisis. Finally, countries with high gnp per capita are found to be more creditworthy.

It is important to note several other specifications to confirm the robustness of our findings. First, our findings are not a consequence of a few extraordinarily influential observations. Specifically, if Mexico and Brazil (the largest two exposure countries) are deleted from the sample all the findings continue to hold. Second, our findings continue to hold even when we control for the size of the country. To control for the size of the country we have replaced the per capita real gnp with real gnp.[7]

Two important findings that emerge from these tables are important findings of this paper: First, independent of the specific form employed to control for repayment prospects of the borrowers, the exposure of banks to a country continues to hold an important role in determining the magnitude of secondary market discounts. In particular, high bank exposure to a country leads to smaller secondary market discounts. The elasticity of discounts with respect ot bank exposure is 10-15 percent in most specifications. Second, we find that increased bank capital increases the secondary market discounts. The magnititude of this impact is substantial: near 25 cents on the dollar for 8 billion U.S. $. (It is also important to note that when the exposure, and capital of the largest 24 U.S. banks are employed, instead of the largest 9 banks, the results we obtain are very similar to the ones reported in Tables 3-6.)

3. How Does Deposit Insurance Affect Secondary Market Prices ?

3.1 A Model

This section presents a model of the influence of deposit insurance on the pricing of developing country debt. In particular, the model examines how a representative bank that can trade in the secondary market and that is subject to deposit insurance, capital requirements and accepted accounting principals. Subsequently, the model is simulated by using exposure data for the largest U.S. banks.

In this two period model, the bank's loan portfolio consists of two kinds of loans: domestic and foreign. The bank's exposure to country i, L_i^f, is long term and given by history in the first period. Country i defaults with probability π_i^d, in which case the bank will not receive any payment from the country. In case of no default, foreign loans pay the principal and the foreign interest rate r_i^f. The domestic loan portfolio, denoted L^h, is short-term yielding a certain domestic return r^h. The bank can adjust its domestic loan portfolio by making new loans in the first period, and adjust its foreign loan portfolio by engaging in trading in the secondary markets.

Deposits, denoted D, are assumed to be partly insured by a deposit insurance agency and the deposit holders are risk neutral[8]. The average, effective interest rate, r^e, that banks have to pay to attract deposits is:[9]

$$r^e = d^s r^s + d^u r^u \tag{4}$$

where, d^s and d^u are the shares of insured and uninsured deposits, and r^s and r^u are the safe interest rate and the rate on uninsured deposits respectively.

Assuming that the bank will be closed in the future period if the value of the bank's assets is less than the value of its liabilities, the future value of the bank is described below:[10]

(5) $$B = (1+r^h)L^h + V - (1+r^e)D \qquad \text{if } V + V^* > 0,$$
$$= 0 \qquad \text{otherwise},$$

where $V^* = (1+r^h)L^h - (1+r^e)D$.

V = expost value of foreign loan exposure.

The bank's capital, denoted K, is asssumed to be given, and the regulators impose minimum capital requirements on domestic and foreign loans denoted θ^h and θ^f, respectively.[11]

Let us now turn to the buying and selling decisions of a bank that observes a secondary market price P_i for a dollar of debt of country i. If the bank decides to sell the debt of a country, which is kept at face value on the books, then the bank realizes a holding loss. This is because the current regulations require the bank to write down all the previously acquired loans to this country. Realized holding losses reduce regulatory capital K. A reduction of regulatory capital losses forces the bank to curtail its domestic loan activities. If these activities are very rewarding, i.e. if the spread between domestic loan and deposit rates is very large, then such a write down is prohibitively unprofitable.[12] Thus banks' ability to carry developing country debt at face value effectively prevents sell offs of these loans.

A bank that buys developing country debt can carry its debt at market value without a write down of any previously acquired loans. Despite this favorable accounting treatment of debt purchases, banks can only expand their portfolio's in any direction to the extent that they have excess regulatory capital. In the remainder of this section, we assume that the bank has one dollar of excess capital, which clearly restricts the bank's demand for developing country debt. The bank is assumed to be interested in maximizing expected bank value in the second period. Secondary market prices a bank is willing to pay are then determined competitively by the condition that the bank can increase expected bank value equally by expanding its portfolio by purchasing loans to any country or by expanding its domestic loan porfolio.[13]

To determine what developing country debt is worth to the bank it has to calculate the probabilities of states of nature in which holding this debt is going to contribute towards the value of the bank. These probabilities crucially depend on the relative size of banks' exposure to developing countries. This is because the bank's exposure to country j can only be worth something to the bank in the next period in those states of nature where any losses the bank sustains on its other developing country exposure are not large enough to bankrupt the bank. Accordingly, define π_i^f to be the probability that loans to country i contribute something to the value of the bank:

$$(6) \qquad \pi_i^f = \text{Prob}\ [V^* + (1+r_i^f)L_i^f + V_{-i} > 0] \qquad i = 1,\ldots,n$$

where V_{-j} = the ex post value of the bank's foreign loan portfolio, excluding the bank's exposure to country j.

Conditional on the bank surviving if the country pays, the bank may continue to survive even if the country does not pay. The probability of this event is denoted with $\pi_i^{f\prime}$, where $\pi_i^{f\prime} = \text{prob}\ (V^* + V_{-i} \mid \pi_i^f > 0)$.[14]

Suppose the bank changes its balance sheet by using one dollar of capital to purchase loans in the secondary market. The purchase leads to two effects on expected bank value. First is a direct effect, denoted b_i^f, that holds r^e constant as below:

$$b_i^f = \pi_i^f \left\{ (1-\pi^d) \left[\frac{1+r^f}{\theta^f P_i} - \left(\frac{1}{\theta^f} - 1 \right)(1+r^e) \right] - \pi^d \pi_i^{f'} \left(\frac{1}{\theta^f} - 1 \right)(1+r^e) \right\} \tag{7}$$

The second effect of the purchase on the bank value is the interest effect through the adjustment of r^e. To see this define S_i^f as the surplus generated from purchasing loans in the secondary market, to be divided between the bank and the deposit insurance agency (note that depositors on average require a return r^s)[15]. If all deposits are uninsured then the expected gain to the bank is all of the surplus S_i^f.[16] In contrast, if all deposits are insured, then $r^e = r^s$ and the bank gains b_i^f as in (7). Accordingly, if part of deposits are insured, the expected gain taking into account both the direct balance sheet and indirect interest rate effects is:

$$b_i^{f'} = (1-d^u)\, b_i^f + d^u\, S_i^f \tag{8}$$

Analogously, define π^h to be the probability that one additional dollar of domestic loans is going to contribute something to the future value of the bank, and $b^{h'}$ to be the expected gain from allocating one dollar capital to backing domestic loans.

For the case where the bank holds domestic loans as well as loans to all n countries and the capital requirement is binding, the optimality conditions require that $b_i^{f'} = b^{h'}$ for all i.[17] Accordingly, P_i is implicitly defined as a function of all the exogenous variables, in particular capital requirements, the bank's capital, the total size distribution of developing country loan portfolio, the country's default probabilities, the given interet rates and the extent of deposit insurance.

3.2 Simulation Method

To simulate the model described in the previous section, we need to compute π_h, π_i^f and $\pi_i^{f'}$. A direct method for implementing this model involves considering every possible outcome (i.e., every permutation of countries and defaults/payments), each weighted by its probability, and the fraction of successful outcomes. This method is unsuitable for a large sample of N countries, because the number of outcomes to be considered is 2^N. To overcome this obstacle, we employ an algorithm for a large but finite number of representative outcomes, taking advantage of the law of large numbers to ensure accuracy of the results.

The algorithim is a very simple Monte Carlo procedure: A representative event is generated by obtaining a default/payment from each country according to the following rule:

(9) $$\text{RND} < \pi_i^d \quad \text{implies default,}$$

where RND = a random number on the (0,1) interval.

Accordingly, the outcome (bank failure or solvency) of the event is determined by summing the payments from all nondefaulting countries, i.e., computing V, and comparing it with V^*. This procedure is repeated m times, to obtain as many events as are desired for statistical precision in the ratio of successful outcomes to total events. Typically, precise results are obtained with $m = 10^4$ events runs, as judged by the reproducibility from run ro run. (This in accordance with the law of large numbers, which suggests relative precision approaches $m^{-1/2}$.) Similarly, to obtain country-specific information on π_i^f and $\pi_i^{f'}$ the algorithm actually used is extended from (9) above to compute modified bank-failure prob·'·:lities conditional upon-payment of the i^{th} country.

3.3 Si.ulation Results

The method just described is employed to simulate the model. In all the simulations, default probabilities of countries are assumed to be equal to focus on the impact of exposure distribution. First, a benchmark case (for 1985) is simulated. Second, the following alternative scenarios are considered: an increase in the default probability of countries, a decrease in banks' capital, an increase in minimum capital requirements, and an increase in the share of insured deposits.

The results of the benchmark simulation and the parameter values are in Table 5 colomn (1). Secondary market prices are positively related to the extent of the country's bank indebtedness as is consistent with our empirical findings (prices range from about 49.9 cents for the smallest debtors to 54.4 cents for Brazil). The probability of the bank's survival is 88.9%, the expected value of the bank is roughly \$19.9 billion, and the expected loss of the deposit insurance agency loss is about \$3.5 billion.

An increase of the default probability, π^d, from 0.50 to 0.70 significantly decreases the bank's chance of survival to 55.7% (column 2). The bank's expected value is reduced, the deposit agency's loss is augmented, and secondary market prices decrease.

Second, we consider a reduction of the amount of bank capital the bank can loose before it is closed, as presented in coulumn 3. This yields a lower survival probability for the bank, lower expected future value of the bank, and higher expected losses for the deposit agency. Lower bank capitalization engenders higher secondary market prices, reflecting the [illegible] higher incentive to gamble with the depositors' money. In the forth [illegible] we present the results for the case of a tighter capi al standards, which are qualitatively similar to a reduction in capital.

Finally, column [illegible] indicates the simulation results for the case where none of the deposits are insured. In this instance, it does not benefit the bank to render its asset portfolio riskier, since the deposit rates it has to pay to attract deposits fully reflect the riskiness of the asset portfolio. Hence, secondary market prices for all countries are the same.[18]

4. Are the Results a Consequence of Implicit Insurance ?

The simulation model shows that the existence of a deposit insurance system can explain the negative relationship between bank exposure to a country and the discount of its debt in the secondary market. However, an alternative explanation maybe based on the behaviour of multilateral lending agencies and creditor country governments.[19] Since one of the aims of these institutions is to increase the stability of the creditor country banking systems, they are more l ely to provide lending to debtors to which banks are more heavily exposed. In this manner the third parties will be enhancing the repayment prospects of those debtors, providing implicit subsidy to the banks. Accordingly, the positive relation between exposure and discounts would be a mere reflection of the enhanced r payment prospects of the borrowers.

In this section we provide evidence that support the view that explicit guarantees by a deposit insurance agency (FDIC) have an impact on the secondary market prices. The first evidence, somewhat cursory in nature, is the time trend of the discounts over the period considered. As presented in Table 6, average discounts increased form 44.8 to 64.7 between the first quarter of 1986 and the final quarter of 1988 The pattern is somewhat puzzling given that a large number of the borrowers, in particular major borrowers have been making net transfers to their creditors. An explanation for this pattern, that is consistent with the implicit insurance explanation may, of course, be that net repayments at present are not good indicators of future repayment prospects. Alternatively, the time pattern of the discounts could be a consequence of the strengthening of the capital position of U.S. banks, which is consistent with our model and empirical estimates.

The second evidence which supports the FDIC explanation of the relationship between bank exposure and secondary market prices, is provided by an investigation of stock market pricing of lender banks. U.S. banks differ widely in the extent of their developing country exposure and capitalization rates, and thus the banks face very different probabilities of ever receiving any payments from the FDIC. The heavily exposed banks thus have a more valuable contingent claim on the FDIC, which to some extent softens the negative impact of developing country exposure on bank valuation. We next describe this by expanding the model of section 3.1.

As before, the bank carries domestic loans, L^h, and developing country debt, L^f. The bank has capital, K, and is subject to a binding uniform capital requirement such that $K = \theta (L^h + L^f)$. Deposits D are equal to $L^h + L^f - K$ from the bank's balance sheet, and there is partial deposit insurance. Let δ be the realized future discount on developing country debt, i.e., the bank will receive $1-\delta$ dollars for every dollar of developing country debt. The discount δ is taken to be uniformly distributed on $[0, \hat{\delta}]$, where $\hat{\delta} \leq 1$. For simplicity, assume that domestic and foreign loans pay a contractual interest of zero, and risk-neutral deposit holders require an expected return of zero as well. In this setting, we can derive the following relation for the expected value, EB, of the bank:

$$\frac{EB - K}{L^h + L^f} = \alpha \left(\frac{L^f}{L^h + L^f} \right) \qquad \text{for } K \geq \hat{\delta} \quad , \tag{10}$$

$$= \alpha' \left(\frac{L^f}{L^h + L^f} \right)^{-1} - \theta \qquad \text{otherwise} \quad ,$$

where $\alpha = -(1/2)\hat{\delta}$ is the mean discount on developing country debt, $\alpha' = \theta^2/(2\hat{\delta})$.

The above equation states that for high values of bank capital, bank value is positive for any realization of δ and the relation between bank value and exposure to developing countries as a share of assets is linear.[20] In contrast, for low values of bank capital the bank can be bankrupted, and hence the bank has contingent claims on the FDIC. In this case, the relation between bank value and share of foreign debt exposure becomes convex. This is because contingent claims on FDIC softens the negative impact of developing country exposure on bank valuation.[21]

We approximate the relation described in equation (10) by the following equation:

$$\frac{EB - K}{L^h + L^f} = \alpha_0 \left(\frac{L^f}{L^h + L^f} \right) + \alpha_1 \left(\frac{L^f}{L^h + L^f} \right)^2 \tag{11}$$

The hypothesis that deposit insurance matters corresponds to $\alpha_1 > 0$.

Equation (11) is estimated for 23 banks.[22] Data are for 1987 and the L^f variable captures the exposure of banks to four large Latin debtor countries: Argentina, Brazil, Mexico, and Venezuela.[23] The regression results are reported in Table (9).[24] The negative estimate of α_c indicates that developing country exposure leads to discounts in the stock market valuation of bank assets. The quadratic term is found positive and statistically significant, supporting the FDIC hypothesis.

The parameter values for equation (11) can also be used to calculate how bank value is affected by a one dollar increase of developing country exposure, which can be called the marginal discount. The evidence, in support of the FDIC hypothesis, indicates that heavily exposed banks value developing country debt more highly at the margin than the less exposed banks (as reported in Table 9). The calculated marginal discounts are consistent with the trend that the smaller, regional banks are more aggressively using the secondary market to reduce their developing country exposure. The wide disparity of marginal discounts also indicates that there are large profitable trading opportunities for interbank trades, as U.S. banks can increase their combined expected claim on the deposit insurance agency by trading developing country debt.

The varying valuation of developing country debt across banks cannot be explained by any differences in treatment of indebted countries by national governments or multilateral lending agencies that may give rise to differing repayment prospects across countries. As banks tend to hold developing country loan portfolio's of more or less equal composition, such differential treatment of countries can not explain different valuation of developing country debt across banks.[25]

5. Concluding Remarks

This paper has empirically demonstrated that secondary market discounts are negatively-related to banks' exposure to countries. The evidence also suggest that discounts and bank capital are strongly positively related over time. The results are explained with the aid of a simulation model, which incorporates deposit insurance combined with limited liability. In this model, secondary market pricing is motivated by banks' desires to reshuffle developing country loan portfolio's so as to increase the value of their implicit claim on the deposit insurance agency.

The observed negative relationship between between bank exposure and secondary market discounts can also be explained by the alternative hypothesis that the multilateral lending agencies and creditor country governments tend to favor lending to the larger debtor countries.[26] Our evidence for a convex relation between stock market valuation of banks and developing country exposure, however, supports the view that contingent claims on the deposit insurance agency are important determinats of secondary market prices. The strong positive correlation of discounts and bank capital over time is further evidence that is consistent with the explanation provided in this paper.

A main result of our model is that bank regulation, and in particular capital requirements, can have repercussions for prices in the secondary market. The model suggests that a tightening of capital standards can be expected to increase secondary market prices, as it forces domestic banks to curtail potentially profitable lending activitities that can generate income to serve as a buffer against bankruptcy. Conversely, the sometimes applied policy of capital forbearance which is the loose application of capital reachivements provides banks with a potential opportunity to earn their way back to solvency, with a negative price effect on developing country debt.

Overall, creditor country factors such as the exposure distribution of banks portfolio, and the regulatory environment are demonstrated to be important determinants of secondary market prices. These findings strengthen the arguments that buybacks may be harmful to countries and undermine the arguments for using secondary market prices as indicators of a country's repayment prospects. In addition, our evidence supports the view that deposit insurance biases banks against providing debt relief.

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Endnotes

[1]Bulow and Rogoff (1988) result that the market price rises after a buyback is no longer necessarily correct, however, as after the buyback the average expected payout from the deposit insurance agency may be reduced, yielding a lower market price, even if the average expected payment per dollar of debt from the country rises.

[2]See Ozler (1989) for empirical evidence on how reschedulings have affected bank value.

[3]From the estimation of (1) one obtains ω and Ω, where they are the density and distribution functions of the standard normal evaluated at $(\beta\ \phi/\ \sigma_1)$ respectively. The ratio ω/Ω is the hazard rate.

[4]Variance of ϵ_2 isgiven by eq. (89), Amemiya(1984), p32.

[5]Heckman's method does no require the joint normality of D* and T*. The detailed discussion of the method summarised here and the underlying assumptions are in Amemiya pp13, and pp32-33.

[6]The only exception is specification (3). Because of difficulties in estimation, debt to private creditors has been left out for Model 2 specification (3).

[7]We have also the discount equation by ordinary least squares. The results obtained for several of the specifications appear similar.

[8]As in Penati and Protopapadakis (1988), these shares are determined outside the model as the financing decision of the commercial banks is beyond the scope of this paper.

[9]If the bank fails, then uninsured deposit holders get a return r^b, and the probability of bankruptcy is π^b. Since the depositors are risk neutral the following relation holds:

$$r^s = (1-\pi^b)r^u + \pi^b r^b.$$

[10]Of course, banks are often closed before the market value of assets has declined to the market value of liabilities. The probability of bankruptcy π^b is equivalent to the probability that B is zero. The bankrupcty case expected gross return $1 + r^b$ on uninsured deposits is the expected value of

$$[(1+r^h)L^h + V]/D.$$

[11]At least in the short run, this is a reasonable assumption as it takes time to build capital through retained earnings or by floating new equity.

[12]In practice, banks that have to retrench may have to sell assets at distress prices which makes retrenchment even more unpprofitable.

[13]The limitation of a bank's regulatory capital prevents it from heavily skewing its portfolio towards holding the debt of a single debtor country. Other reasons that banks do not specialize in one country's debt are restrictions that limit a bank's exposure to any one borrower to a maximum of 15% of bank capital, and the existence of asymmetric information on the part of banks regarding certain loans to especially private debtors in developing countries that make these loans untradeable.

Finally, an important reason that specialization will never occur is that such specialization would endanger the health of the banks and thus the jobs of the managers that make the bank's asset allocation decisions. Generally, managers that consider restructuring their bank's debt portfolio face a trade off between maximizing bank value and job security. Consider a model of identical banks that hold debt to two countries and that are controlled by managers interested in bank vaule as well as job security. In this context it can be shown that a relative debt price exists at which no bank wishes to trade. The result does not depend on the bias introduced by minimum capital requirements against selling a country's debt in the secondary market. Further assumptions to obtain this result are that the returns to the loans to the two countries are normally independently distributed, and that banks can change debt portfolio's among themselves through small but non-negligible swaps. Loans to the relatively heavily indebted country can trade at a higher discount or lower relative price, depending on the realtive weight the managers attach to maximizing bank value and safe guarding their own jobs.

[14]The values for $\pi_i^{f'}$ will be close to one for small countries, as the repayment of small countries hardly influences the chances of survival of the bank, but they may be small for large countries.

[15]This quantity is given by $((1-\pi^d)(1+r^f)/\theta^f\ P_i)-((1/\theta^f-1)(1+r^s))$.

[16]This is because the bank, before as well as after the purchase, has to guarantee depositors an expected return of r^s.

[17]A sufficient condition for the capital requirement to be binding is $r^h > r^e$.

[18]Note that the price is less than fifty cents, eventhough the default probability π^d is assumed to be 0.50, as the rate the bank earns on domestic loans is assumed to be above the rate earned on foreign loans.

[19]One may argue that the negative relation between discount and exposure is because banks increase their exposure to low discount countries, reversing the causality. This argument, however, is not consistent with the fact that banks stopped making new loans to developing countries. Trading in the secondary markets followed this general cut off of new loans to developing countries.

[20]We maintain that the market value of bank preferred equity, deposits and dommestic loans can be approximated by book values. Also note that the linear relation described for high capital values would continue to hold if there were no deposit insurance.

[21] In this case the expected value of the bank is given by the following equation:

$$EB = \int_0^{K/L^f} [L^h + (1 - \delta)L^f - D]\frac{1}{\delta}\, d\delta = \frac{K^2}{2\delta L^f}, \text{ as } K = L^h + L^f - D.$$

For the derivation of equation (10) also recall the presence of capital requirements.

[22] Variables are measured as follows: EB = market value of common equity calculated as the stock price times the number of shares outstanding, K = book value of common equity plus loan loss reserves, L^f = book value of developing country loan exposure, $L^f + L^h$ = total assets plus loan loss reserves.

[23] Stock price data are for November 31, 1987. All other data, and, in particular, bank exposure data, is for the end of 1987. The limitation to four countries is because banks are required to disclose developing country exposure to individual countries only if in excess of 1 percent of assets. The banks in our sample have all reported exposure to each of four countries.

[24] Estimation of (11) without the quadratic term yields an estimate of α of -0.641 with a t-statistic of -10.87. Note that alternative specifications are possible where the market value of, for instance, a bank's preferred equity, liabilities or non-LDC assets is left to be determined by the data rather than assumed to be unity a priori. A modified specification of (11) which leaves the value of non-LDC assets unconstrained (corresponding to Sachs and Huizinga (1987) and Huizinga (1989) yields that the value of non-LDC assets is estimated at 1.00 with strong significance.

[25] Exposure to Latin America scaled by exposure to all developing countries is approximately the same when the largest banks are compared to the smaller banks: the ratio is .60, .63, .61 for the top 9, next 15, and the remaining near 150 banks respectively at the end of 1987.

[26] Additional hypotheses can be constructed from considering the bargaining strenth of banks and different kinds of countries vis-a-vis each other. Without an explicit bargaining model, however, one can not sort out the consequences of this approach.

Table 1. Sample Characteristics

(1986-1988)

For Countries Whose Assets Are:[a]

	Traded		Not Traded	
	Mean	Standard Deviation	Mean	Standard Deviation
Detex	4.08	2.45	2.60	2.14
Resimp	1.16	0.98	0.98	0.72
RGNP	1.23	0.78	1.87	2.00
Inf	0.10	0.13	0.02	0.02
InvGNP[b]	0.17	0.05	0.22	0.06
DetGNP	0.74	0.39	0.40	0.16
ResGNP	0.21	0.17	0.39	0.64
ImpGNP	0.23	0.12	0.37	0.36
Agr	0.98	0.13	0.02	0.14
Incrat[c]	0.19	0.09	0.09	0.04
Agrat[c]	0.15	0.07	0.20	0.12
Pridebt	4.72	6.48	3.50	4.12

(Variable definitions and sources are provided below)

[a]The countries whose debt is traded in the secondary market are: Argentina, Bolivia, Brazil, Chile, Colombia, Costa-Rica, Dominican Republic, Ecuador, Honduras, Ivory Coast, Jamaica, Liberia, Malawi, Mexico, Moracco, Panama, Peru, Philippines, Sudan, Turkey, Uruguay, Venezuela, Yugoslavia, Zaire, Zambia.

The remaining countries in our sample are: Cameroon, Egypt, El Salvador, Ethiopia, Greece, Hungary, India, Indonesia, Israel, Jordan, Kenya, Korea, Pakistan, Paraguay, Portugal, Singapore, Sri Lanka, Thailand, Trinidad & Tobago, Tunisia, Zimbabwe.

[b]This variable is not available for Argentina, Mexico, Sudan, Turkey and Zaire.

[c]These series are obtained from Sachs and Berg (1988) and are not available for Bolivia, Cameroon, Dominican-Republic, El Salvador, Ethiopia, Greece, Honduras, Jamaica, Jordan, Liberia, Malawi, Pakistan, Sri Lanka, Sudan, Venezuela, Zaire, Zambia, Zimbabwe.

Table 1 (continued)

Variable Definitions and Sources

(Variables that are not noted as quarterly are measured as annually)

Detex :	Ratio of total public outstanding debt to exports (exports are quarterly)
Resimp :	Ratio of total reserves to imports (both quarterly)
RGNP :	GNP per capita in thousands of 1986 U.S. dollars
Inf :	Rate of inflation (quarterly)
InvGNP :	Ratio of domestic investment to GNP
DetGNP :	Total public debt to GNP ratio
ImpGNP :	Imports to GNP ratio (imports are quarterly)
ResGNP :	Reserves to GNP ratio (reserves are quarterly)
Agr :	A dummy variable indicating that a country has signed a rescheduling agreement with its bank creditors.
Incrat :	A measure of income distribution, defined as the ratio of the highest income quartile to the lowest income quartile for the early 1970s. The variable is available only for the cross-section of some countries.
Agrat:	Agriculture to GDP ratio averaged over the period of 1970-1981.
Pridebt:	Debt outstanding to private creditors in billions of U.S. dollars (quarterly).

Sources: International Financial Statistics (IMF), World Debt Tables (The World Bank), Sachs and Berg (1988).

Table 2. Secondary Market Discounts and Bank Exposure

Country	Discount	Deviation	Spread	Exposure
Argentina	53.34	18.75	2.82	6.52
Bolivia	91.31	2.00	18.32	0.04
Brazil	41.01	13.68	2.42	15.80
Chile	36.94	4.75	2.43	3.89
Colombia	23.93	10.18	2.00	1.45
Costa Rica	70.67	15.16	9.49	0.19
Dominican Republic	65.42	11.90	7.05	0.28
Ecuador	54.31	19.42	4.30	1.16
Honduras	67.29	8.42	8.46	0.05
Ivory Coast	43.95	21.64	5.56	0.28
Jamaica	59.72	4.99	9.42	0.11
Liberia	91.60	5.12	37.72	0.02
Malawi	26.85	1.53	4.40	0.03
Mexico	46.74	5.10	2.38	13.19
Morocco	38.77	9.44	3.16	0.59
Panama	49.14	21.37	5.97	0.51
Peru	87.80	6.41	18.63	0.54
Philippines	40.50	8.29	3.03	3.32
Sudan	95.77	3.74	61.90	0.01
Turkey	2.54	0.65	1.46	1.09
Uruguay	36.12	4.73	2.91	0.67
Venezuela	35.96	12.33	2.14	6.02
Yugoslavia	34.91	15.99	2.46	1.23
Zaire	77.91	2.80	13.88	0.01
Zambia	83.41	3.50	17.47	0.06

Notes: Discount is the mean of (100-bid price) for the 1986-88 period.
Deviation is the standard deviation of the discounts.
Spread is calculated as the percentage difference between the bid and ask prices.
Exposure is for the nine largest U.S. banks in $ billion.

Sources: Indicative Prices for Less Developed Country Bank Loans, Salomon Brothers, various issues, and Country Exposure Lending Survey, Federal Financial Examination Council, various issues.

Table 3: Probit Specification-Model 1 (t-values are in parentheses)*

	(1)	(2)	(3)	(4)	(5)
Pridebt	.28E-06 (6.86)	.28E-06 (5.89)	.38E-07 (4.64)	.62E-06 (4.46)	.29E-06 (6.84)
Debtexp	.10E-02 (2.85)	.79E-03 (1.89)	.97E-03 (1.27)	.35E-03 (.35)	.11E-02 (2.98)
Resimp	-.85E-02 (-6.45)	-.79E-02 (-5.71)	-.12E-01 (-4.09)	-.16E-01 (-4.09)	-.84E-02 (-6.23)
Rgnp	-.90 (-5.29)	-.60 (-2.83)	-2.03 (-4.16)	-6.48 (-5.14)	-.91 (-5.16)
Inf	.16 (6.92)	.10 (3.79)	.31 (5.27)	.51 (4.91)	.17 (6.92)
Latin	4.06 (9.83)	4.28 (9.14)	7.86 (4.76)	11.81 (5.17)	4.29 (9.29)
Africa	1.93 (5.51)	1.96 (5.16)	2.35 (3.80)	3.77 (3.73)	2.15 (6.09)
Invgnp		-.89E-01 (-4.78)			
Incrat			.58E-01 (1.96)		
Agrat				-.39E-01 (-3.89)	
Constant	-1.80 (-3.40)	-0.34E-01 (-.49)	-2.44 (-2.95)	9.14 (3.30)	-1.92 (-3.55)
McFadden R-Square	.57	.58	.74	.84	.57
% of Right Predictions	.86	.89	.89	.93	.87
Nobs. at 1:	254	187	174	174	239
Nobs. at 0:	227	215	152	149	227

*Not reported here are quarterly dummy variables. All the ratios are measured in percentages, ex9 is the top nine U.S. bank exposure in thousands of 1986 U.S.$.

Table 4: Heckman Equation-Model 1 (t-values are in parentheses)*

	(1)	(2)	(3)	(4)	(5)
Lnex9	-.13	-.17	-.14	-.16	-.5E-01
	(-6.52)	(-6.97)	(-3.35)	(-2.70)	(-1.96)
Lnk9	3.48	2.75	3.56	4.31	2.65
	(3.50)	(3.56)	(2.81)	(3.44)	(2.72)
Pridebt	.83E-08	.15E-07	.11E-07	.10E-07	-.67E-09
	(1.54)	(2.39)	(1.62)	(1.32)	(-.13)
Debtexp	.38E-03	.35E-03	.11E-03	.24E-03	.25E-03
	(3.46)	(2.39)	(.53)	(1.50)	(2.17)
Resimp	-.61E-03	-.32E-03	-.15E-02	-.43E-03	-.73E-03
	(-1.84)	(-.71)	(-2.09)	(-1.09)	(-2.53)
Rgnp	-.61E-01	-.14	-.70E-01	-.23	-.50E-01
	(-1.04)	(-2.96)	(-1.13)	(-4.26)	(-1.01)
Inf	.10E-01	.56E-02	.12E-01	.79E-02	.86E-02
	(4.20)	(2.90)	(4.27)	(3.28)	(3.43)
Latin	1.11	.28	1.71	.88	.91
	(4.31)	(1.57)	(4.61)	(3.44)	(3.97)
Africa	.76	-.17	.64	.55	.61
	(3.01)	(-1.65)	(2.76)	(2.11)	(2.83)
Invgnp		-.86E-02			
		(-1.34)			
Incrat			-.14E-01		
			(-3.09)		
Spread					.24E-01
					(4.30)
Agrat				-.40E-01	
				(-7.20)	
Millsinv	.13	.11	.78	.27	.62E-01
	(.67)	(.81)	(3.03)	(.88)	(.33)
Constant	-57.00	-42.26	-58.28	-70.45	-43.29
	(-3.24)	(-3.13)	(-2.61)	(-3.34)	(-2.50)
Adj. R-sqr.	.39	.45	.37	.36	.48

*Dependent variable for 5 is log(100-bidprice), for others bid and ask average is used. See also the notes to Table 3. Lnk9 is the log of capital for 9 banks.

Table 5: Probit Specification-Model 2 (t-values are in parentheses)

	(1)	(2)	(3)	(4)	(5)
Pridebt	.53E-06	.11E-06		.17E-05	.55E-06
	(5.35)	(3.85)		(2.99)	(5.28)
Debtgnp	.17	.31	.15	.42	.18
	(5.86)	(3.93)	(4.85)	(2.67)	(5.60)
Resgnp	-.83E-01	-.85E-01	-.17E-01	-.24	-.83E-01
	(-3.94)	(-2.24)	(-.84)	(-2.94)	(-3.85)
Impgnp	-.67E-01	-.79E-01	-.13	.12	-.71E-01
	(-2.71)	(-1.65)	(-2.31)	(1.45)	(-2.76)
Rgnp	-.62	-1.07	-.32E-01	-16.13	-.59
	(-1.75)	(-1.56)	(-.061)	(-2.88)	(-1.66)
Inf	.46	.77	.49	1.99	.47
	(5.12)	(3.49)	(4.08)	(2.92)	(5.00)
Latin	5.65	10.53	1.53	3.03	5.84
	(5.41)	(3.81)	(1.06)	(2.99)	(5.27)
Africa	1.41	1.30	-4.70	1.43	1.43
	(1.65)	(0.97)	(-3.51)	(.70)	(1.51)
Invgnp		-.32			
		(-3.34)			
Incrat			.38		
			(3.48)		
Agrat				-1.21	
				(-2.52)	
Constant	-10.46	-14.76	-10.49	-0.41	-11.29
	(-5.04)	(-0.50)	(-3.79)	(-.50)	(-4.88)
McFadden R-Square	.86	.92	.89	.90	.85
% of Right Predictions	.95	.97	.96	.97	.96
Nobs. at 1:	256	189	176	176	241
Nobs. at 0:	227	215	152	152	227

* See notes to Table 3

Table 6: Heckman Equation-Model 2 (t values are in parentheses)

	(1)	(2)	(3)	(4)	(5)
Lnex9	-.11 (-4.95)	-.15 (-6.43)	-.11 (-2.83)	-.17 (-2.27)	-.32E-01 (-2.05)
Lnk9	2.87 (3.56)	2.38 (3.38)	5.25 (4.92)	4.34 (3.94)	2.39 (2.72)
Pridebt	.13E-08 (.27)	.98E-08 (1.84)		.14E-07 (1.69)	-.57E-08 (-1.01)
Debtgnp	.51E-02 (4.18)	.79E-02 (6.45)	.14E-01 (5.50)	.11E-01 (3.80)	.50E-02 (4.30)
Resgnp	-.35E-02 (-2.46)	-.24E-02 (-1.63)	-.65E-02 (-2.31)	-.35E-02 (-1.49)	-.29E-02 (-2.62)
Impgnp	-.85E-02 (-2.55)	-.11E-01	-.66E-02 (-.62)	-.14E-01 (-1.07)	-.60E-02 (-2.03)
Rgnp	-.27E-01 (-.45)	.[illegible]-01 (.26)	-.88E-01 (-1.36)	-.41E-01 (-.48)	-.11E-01 (-.22)
Inf	.56E-02 (2.62)	.42E-02 (2.14)	.14E-01 (3.62)	.52E-02 (1.97)	.52E-02 (2.65)
Latin	.68 (2.94)	-.33E-01 (-.35)	1.30 (4.10)	.43 (1.55)	.58 (2.86)
Africa	.24 (.96)	-.58 (-6.47)	.43 (1.76)	-.55E-01 (-.18)	.19 (.88)
Invgnp		-.10E-01 (-1.97)			
Incrat			-.49E-02 (-1.14)		
Spread					.25E-01 (4.57)
Agrat				-.25E-01 (-3.17)	
Millsinv	-.60 (-2.19)	-.31 (-2.70)	1.63 (5.07)	-.72 (-1.67)	-.40 (-1.60)
Constant	-46.66 (-3.48)	-35.98 (-2.94)	-48.22 (-4.45)	-50.66 (-3.66)	-38.49 (-2.48)
Adj.R-Square	.45	.59	.52	.41	.52

* See notes to Table 4.

Table 7. Simulations for Alternative Parameter Values[a]

Results[b]	(1)	(2)	(3)	(4)	(5)
π^h	88.9	55.7	51.2	86.3	88.3
EB	19.9	11.4	10.8	19.3	19.8
EL	3.5	6.1	8.0	4.0	0
L^h	644.6	644.6	439.6	468.4	644.6
D	662.7	662.7	470.0	486.5	622.7
r_e	8.3	8.5	8.7	8.3	8.4
	Secondary Market Prices: Cents on one $U.S.				
Argentina	52.23	33.47	56.59	52.09	.
Bolivia	49.91	29.98	49.92	49.90	.
Brazil	54.36	45.07	66.62	55.40	.
Chile	51.34	32.31	53.97	51.21	.
Colombia	50.60	31.24	52.00	50.56	.
Costa Rica	49.98	30.13	50.17	49.96	.
Dominican Republic	50.02	30.20	50.22	49.99	.
Ecuador	50.30	31.87	51.21	50.30	.
Honduras	49.91	29.97	49.94	49.90	.
Ivory Coast	49.80	30.15	50.22	49.97	.
Jamaica	49.95	30.06	50.03	49.92	.
Liberia	49.93	30.01	49.99	49.91	49.88
Malawi	49.91	29.97	49.93	49.89	.
Mexico	54.56	43.64	62.79	55.42	.
Morocco	50.13	30.32	50.61	50.13	.
Panama	50.17	30.44	50.65	50.10	.
Peru	50.23	30.63	50.83	50.18	.
Philippines	51.18	30.044	42.66	50.99	.
Sudan	49.91	29.96	49.94	49.90	.
Turkey	50.35	30.89	51.49	50.35	.
Uruguay	50.16	30.27	50.61	50.08	.
Venezuela	52.76	34.07	57.98	52.46	.
Yugoslavia	50.40	30.97	51.43	50.35	.
Zaire	49.89	29.94	49.89	49.88	.
Zambia	49.89	29.97	49.97	49.89	.

[a]

Parameters for column (1) (bill Year 1985)

K = \$42.3, capital for the top 9 money-center banks
θ^h = .06, current capital requirement for domestic loans in the U.S.
θ^f = .06, current capital requirement for foreign loans in the U.S.
r^f = 9.11%, 1-year Libor rate (7.61) plus a spread of 1.5%
r^h = 10.87%, ex-post return on domestic loans (net of loss provisions for U.S. banks.
r^s = 8.29 actual rate paid for all liabilities by insured commercial banks.
π^d = 0.50
ds = .75

Parameters for columns (2)-(5)
All parameters are as in column (1) except in column 2) π^d = .7, in (3) K = \$30.0 billion, in (4) θ^h and θ^f are 0.08 and in (5) ds = 0.

[b] Notation

π^h = probability of bank survival, percent
EB = expected value of the bank (\$ billion)
EL = expected loss of deposit agency (\$ billion)
L^h = volume of domestic lending (\$ billion)
D = volume of liabilities or deposits (\$ billion)
r_e = average effective deposit rate, percent.

Notes: We made a downward adjustment income equivalent to 1.85 cents per dollar of assets. This adjustment is to account for non-interest expenses.

Sources: Federal Reserve Financial Examination Council, Country Exposure Lending. "The Profitability of Insured Commercial Banks in 1987," Federal Reserve Bulletin, v. 7n, #7, July 1988.

Table 8

Secondary Market Discounts and Bank Capital

Year	Quarter	Discount	Capital
1986	1	44.8	44.3
	2	44.9	44.3
	3	45.1	45.0
	4	45.1	46.1
1987	1	43.7	47.8
	2	47.1	49.1
	3	52.8	49.8
	4	59.6	50.1
1988	1	60.9	50.1
	2	61.4	50.6
	3	62.3	50.9
	4	64.7	52.0

Notes: Discounts are calculated as the average of bid and ask prices. Capital includes equity, subordianted debentures and reserves for loan losses. The figures are for the nine largest U.S. banks in 1986 U.S. $ bill.

Table 9 Stock Market Valuation

A Estimated equation (11): Method OLS

α_0	α_1	Nobs.	Adj R^2
-1.057	7.099	23	0.46
(-6.43)	(2.67)		

B. Implied Marginal Discounts for U.S. Banks.

Bank	Exposure to Latin four (millions)	Exposure to Latin four/ assets plus loan loss reserves (percentage)	Marginal discount
Citicorp	9,100	4.37	-0.41
Chase Manhattan	6,440	6.32	-0.31
BankAmerica	7,025	7.31	-0.26
Chemical	4,401	5.48	-0.36
J.P. Morgan	4,350	5.64	-0.35
Man. Hanover	6,571	8.65	-0.19
Sec. Pacific	1,558	2.09	-0.53
Bankers Trust	2,778	4.81	-0.39
First Interstate	1,047	2.01	-0.54
First Chicago	2,237	4.89	-0.39
Wells Fargo	1,542	3.39	-0.47
PNC Financial	322	0.87	-0.60
Bank of Boston	851	2.44	-0.52
Mellon	1,111	3.51	-0.46
Bank of New Eng.	261	0.87	-0.60
First Bank System	307	1.13	-0.59
Irving Bank	1,391	5.74	-0.34
Bank of N.Y.	533	2.27	-0.52
Republic N.Y.	455	2.01	-0.54
Norwest	285	1.35	-0.57
Midlantic	261	1.45	-0.57
National City	196	1.29	-0.58
Mercantile Bank	188	2.71	-0.50

Notes: Marginal discouts are for total developing country exposure of U.S. banks. To obtain this quantity, the parameter estimates for α_0, and α_1, as well as the exposure to Latin four/ assets ratio in the second column are adjusted. The factor used for this adjustment is 0.61, which is the share of the Latin four in the exposure of all U.S. banks in 1987 to all developing countries.

Sources: 10-K reports, Salomon Brothers' Review of Bank Performance, and the Wall Street Journal.

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